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10/767,247	01/28/2004	Naoki Watanabe	16869B-077300US	4787

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EXAMINER	
CAMPOS, YAIMA	
ART UNIT	**PAPER NUMBER**
2185	

DATE MAILED: 06/16/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/767,247	WATANABE, NAOKI	
	Examiner	Art Unit	
	Yaima Campos	2185	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

RESPONSE TO AMENDMENT

1. The examiner acknowledges the applicant's submission of the amendment dated April 19, 2006. At this point claims 1, 9 and 10 have been amended, no claims have been cancelled, and claims 15-20 have been added. There are 20 claims pending in the application; there are 2 independent claims and 18 dependent claims, all of which are ready for examination by the examiner.

I. OBJECTIONS TO THE SPECIFICATION

Claim Objections

2. **Claims 1, 2, 8, 10, 11, 15 and 18** are objected to; the term "potential failure" should be changed to **–failure-**.

3. Appropriate correction is required.

II REJECTIONS BASED ON PRIOR ART

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. **Claims 1-9 and 10-14** are rejected under 35 U.S.C. 103(a) as being unpatentable over Bridge (US 6,530,035).

1. As per **claim 1**, Bridge discloses "A method of controlling a storage system having primary storage volumes and replication storage volumes which replication storage volumes

improve reliability of the storage system," as **["the invention relates to a method and system for managing storage systems containing multiple storage devices" (Column 1, lines 9-11) and also that "to protect against the loss of information, data on the system can be *mirrored* (i.e., duplicated and stored) on two or more separate storage locations" (Column 1, lines 50-52). Bridge also explains that "if a disk drive fails, protected extents can be rebuilt from that disk drive's mirror partners" (Column 14, lines 53-54) and that "this reduces the meantime to repair the failure with a hot standby, since a higher I/O rate can be used to reconstruct lost data" (Column 14, lines 56-58) wherein "a lower mean time to repair reduces the probability of having two simultaneous failures" (Column 14, lines 61-62); therefore, providing higher reliability in a storage system]**

"the method comprising: determining a boundary of a potential failure of the primary storage volumes and the replication storage volumes;" **[With respect to this limitation, Bridge discloses an equivalent method wherein "each disk drive is associated with a failure group. Two disk drives are in different failure groups if they do not share a common failure condition that is projected to affect both disk drives at the same time" (Column 2, lines 42-46) as failure groups encompass different failure boundaries]**

"and using the determined boundary to assign replication storage volumes to assure that at least some of the replication storage volumes are outside the failure boundary" **[Bridge discloses this limitation as "for mirroring, each disk drive is paired with one or more disk drives from other failure groups" (Column 2, 51-52) so that "two independent failures would be required to destroy both pieces of the data" (Column 4, lines 32-33); therefore, a mirror copy of a drive belongs in a different failure boundary as its mirror pair]**.

Bridge discloses accessing storage volumes either sequentially or in parallel **[(Columns 8-9, lines 40-67 and 1-4)]**; however, Bridge does not disclose expressly "wherein the primary storage volumes and replication storage volumes are horizontally or are vertically addressed."

At the time of the invention it would have been obvious to a person of ordinary skill in the art to use horizontal, vertical, or another form of addressing well known in the field of endeavor as Applicant's own disclosure explains that **["the server 106 uses address to indicate horizontal, vertical, or some other form" (Paragraph 0043) and also explains that "in the case of vertical addressing the impact of replication is the same as with example of horizontal addressing; the only differences are the physical arrangement of the storage volumes" (Paragraph 0033)]**.

Therefore, it would have been obvious to use any addressing form for the benefit of creating a method of controlling storage system replication to obtain the invention as specified in claim 1.

2. As per **claim 2**, Bridge discloses "A method as in claim 1," **[See rejection to claim 1 above]** "wherein the potential failure boundary is determined by software managing the storage system" **[With respect to this limitation, Bridge discloses that "all named drives in a failure group share some common disk drive failure criteria, which is any failure mode or condition which is projected to cause the related disk drives to fail at the same time period" (Column 13, lines 35-38) and explains that "hard-wired circuitry may be used in place of or in combination with software instructions to implement the invention" (Column 26, lines 36-40)]**.

3. As per **claim 3**, Bridge discloses "A method as in claim 2" **[See rejection to claim 2 above]** "wherein a logical address of locations in the storage system is used to determine the failure boundary" **[With respect to this limitation, Bridge discloses that "the logical volume manager configures a pool of disk drives into logical volumes (also called logical disks) so that applications and users interface with logical volumes instead of directly accessing physical disk drives" (Column 1, lines 24-27)]**.

4. As per **claim 4**, Bridge discloses "A method as in claim 1" **[See rejection to claim 1 above]** "wherein there are a plurality of failure boundaries and each is determined by software managing the storage system" **[With respect to this limitation, Bridge discloses that "all named drives in a failure group share some common disk drive failure criteria, which is any failure mode or condition which is projected to cause the related disk drives to fail at the same time period" (Column 13, lines 35-38) wherein "there should be at least two failure-groups to implement proper redundancy" (Column 14, lines 55-57) and explains that "hard-wired circuitry may be used in place of or in combination with software instructions to implement the invention" (Column 26, lines 36-40)]**.

5. As per **claims 5-6 and 11-12**, Bridge discloses "A method as in claims 4 and 10" **[See rejection to claim 4 above and rejection to claim 10 bellow]** "wherein information regarding the failure boundaries is stored as a table in the server" and "the server is used to manage the storage system" **[With respect to this limitation, Bridge discloses that "a separate list is maintained for each disk drive with entries that describe each allocation unit on that disk drive. The example of FIG. 4 illustrates one embodiment of this list which is referred to as an *allocation table*" (Figure 4 and Column 10, lines 13-17) wherein "if a disk drive fails, the**

surviving allocation tables can be used to reconstruct any pointer extent on the failed device containing entries for allocation units on surviving devices" (Column 10, lines 41-44) and also explains that when a disk drive fails, "reconstruction can be accomplished by looking at the mirror partner's allocation tables. Thus no other disk drives need to be examined" (Column 14, lines 58-61) as storing failure boundary information for both, primary and secondary (or mirror) volumes of data on each disk; therefore, each disk functions as a server for other disks in the system as each disk stores data pertaining to other disks. Bridge further discloses that "a server might transmit a requested code for an application program through Internet, ISP, local network and communication interface. In accordance with the invention, one such downloaded application manages storage systems that contain multiple data storage devices" (Figure 19 and Column 27, lines 43-49)].

6. As per **claims 7 and 13**, Bridge discloses "A method/system as in claims 5 and 11" **[See rejection to claim 5 above and rejection to claim 11 bellow]** "wherein information regarding the failure boundaries also includes information about reliability of the primary storage volumes and the replication storage volumes" **[Bridge discloses this limitation as "two disk drives on a common controller could be considered part of the same failure group for a high-reliability mirrored data system, but may be considered in two separate failure groups for a system having lower demand-levels for reliability" (Column 15, lines 2-6) as taking reliability information for each failure group into account]**.

7. As per **claim 8**, Bridge discloses "A method as in claim 1" **[See rejection to claim 1 above]** "wherein the boundary of the potential failure is used to assign storage volumes as replication storage volumes for a particular operation of the storage system" **[Bridge discloses**

this limitation as "for mirroring, each disk drive is paired with one or more disk drives from other failure groups" (Column 2, 51-52) so that "two independent failures would be required to destroy both pieces of the data" (Column 4, lines 32-33); therefore, a mirror copy of a drive belongs in a different failure boundary as its mirror pair and failure boundary information is used to assign a mirror pair for a data volume].

8. As per **claim 9**, Bridge discloses "A method as in claim 8" **[See rejection to claim 8 above]** "~~wherein the failure boundary information~~ information relating to the boundary of potential failure includes error correction group and controller group information for each of the primary storage volumes and the replication storage volumes" **[With respect to this limitation, Bridge discloses "using mirror partners also limit the chances of multiple-drive failures damaging a parity protected extent. A parity set is allocated by picking any disk drive as the primary disk to hold the parity extent and then allocating the data extents on its mirror partners. Each data extent should be located on a mirror partner that is in a different failure group from other extents in the parity set" (Column 14, lines 34-40) as including error correction information and further explains that "two disk drives on a common controller could be considered part of the same failure group for a high reliability mirrored data system" (Figure 6 and Column 15, lines 2-4) as including control group information].**

9. As per **claim 10**, Bridge discloses "A storage system comprising: a set of primary storage volumes; a set of replication storage volumes for improving reliability of the storage system;" **as [**"**the invention relates to a method and system for managing storage systems containing multiple storage devices" (Column 1, lines 9-11) and also that "to protect against the loss of information, data on the system can be *mirrored* (i.e., duplicated and stored) on two or**

more separate storage locations" (Column 1, lines 50-52). Bridge also explains that "if a disk drive fails, protected extents can be rebuilt from that disk drive's mirror partners" (Column 14, lines 53-54) and that "this reduces the meantime to repair the failure with a hot standby, since a higher I/O rate can be used to reconstruct lost data" (Column 14, lines 56-58) wherein "a lower mean time to repair reduces the probability of having two simultaneous failures" (Column 14, lines 61-62); therefore, providing higher reliability in a storage system]

"a memory for storing information regarding at least one boundary of a potential failure of the primary storage volumes and the replication storage volumes;" **[With respect tot this limitations, Bridge discloses having "allocation tables" wherein "if a disk drive fails, the surviving allocation tables can be used to reconstruct any pointer extent on the failed device containing entries for allocation units on surviving devices" (Column 10, lines 41-44) and also explains that when a disk drive fails, "reconstruction can be accomplished by looking at the mirror partner's allocation tables. Thus no other disk drives need to be examined" (Column 14, lines 58-61) as storing failure boundary information for both, primary and secondary (or mirror) volumes of data]**

"and a controller coupled to the memory for assigning replication storage volumes to measure that at least some of the replication storage volumes are outside the failure boundary" **[With respect to this limitation, Bridge discloses that "conventional data storage systems include one or more storage devices connected to a controller or manager" (Column 1, lines 13-14) and further explains that "two disk drives on a common controller could be considered**

part of the same failure group for a high reliability mirrored data system" (Figure 6 and Column 15, lines 2-4)]

"the at least one boundary being determined using error correction group and controller group information for the set of primary storage volumes and the set of replication storage volumes" **[With respect to this limitation, Bridge discloses arranging disk drives in different failure groups and explains "using mirror partners also limits the chances of multiple-drive failures damaging a parity protected extent. A parity set is allocated by picking any disk drive as the primary disk to hold the parity extent and then allocating the data extents on its mirror partners. Each data extent should be located on a mirror partner that is in a different failure group from other extents in the parity set" (Column 14, lines 34-40) as including error correction information and further explains that "two disk drives on a common controller could be considered part of the same failure group for a high reliability mirrored data system" (Figure 6 and Column 15, lines 2-4) as including control group information]**.

10. As per **claim 14**, Bridge discloses "A storage system as in claim 11" **[See rejection to claim 11 above]** "wherein information regarding the failure boundaries also includes information about performance of the primary and replication storage volumes" **[With respect to this limitation, Bridge discloses that "the size of allocation units is selected for desired performance characteristics. One factor to consider in this selection is the I/O performance of the disk drive(s) containing the allocation units" (Column 7, lines 16-19) and also explains that "pointer extents can be in a different disk group from data extents. This is useful for cases where one disk group has different performance characteristics than**

another" (Column 9, lines 48-50) as taking performance information for each failure group into account].

11. **Claims 15-16 and 18-19** are rejected under 35 U.S.C. 103(a) as being unpatentable over Bridge (US 6,530,035) in view of Wahl et al. (US 6,618,818).

12. As per **claims 15 and 18** (New), Bridge discloses "A method as in claims 1 and 10" **[See rejection to claims 1 and 10 above]** but does not disclose expressly; "the boundary of a potential failure is determined based on logical addresses."

Wahl discloses that "the boundary of a potential failure is determined based on logical addresses" as **[having storage devices (disk drives) configured within a logical group (Column 12, lines 22-31 and Figure 5) and explains that "failure of one logical group 34 does not affect the operations of any other logical groups" (Column 12, lines 33-59); therefore, logical groups form different failure boundaries]**.

Bridge and Wahl are analogous art because they are from the same field of endeavor of computer memory access and control.

At the time of the invention it would have been obvious to a person of ordinary skill in the art to modify the mirroring system which has failure groups formed by different disks sharing similar characteristics as taught by Bridge and have these failure groups of physical disk form logical groups as taught by Wahl; thereby defining a boundary of potential failure by logical addresses/logical groups.

The motivation for doing so would have been because Wahl discloses that grouping storage devices into logical groups **[is done to maintain chronological coherency (Column 12, lines 33-59) and also explains that "the logical groups represent the highest level of**

organization for the computer network remote data mirroring system" (Columns 12-13, lines 60-67 and 1-14) wherein a "failure of one logical group 34 does not affect the operations of any other logical groups" (Column 12, lines 33-59)].

Therefore, it would have been obvious to combine Wahl et al. (US 6,618,818) with Bridge et al. (US 6,530,035) for the benefit of creating a method of controlling storage system replication to obtain the invention as specified in claims 15 and 18.

13. As per **claims 16 and 19** (New), the combination of Bridge and Wahl discloses "A method as in claim 15" **[See rejection to claim 15 above]** "wherein the logical addresses correspond to volume numbers or error correction groups" **[With respect to this limitation, Bridge discloses having parity information within failure groups (Column 14, lines 34-40); therefore, when forming logical groups from these failure groups (See rejection to claims 15 and 18 above), the logical/virtual address correspond the parity/error correction information. Furthermore, it is the examiner's position that in a storage system logical addresses typically correspond to volume numbers, error correction group, or other structure of the storage system; as evidenced by Applicant's own disclosure (Paragraph 0006)]**.

1. . Any system having multiple snapshots would have been useless without some identification, of which snapshot is which. Furthermore; these indicators/names define either a sequential order going back into the past or simple the date and time of creation, which comprise a naming scheme/plan for snapshot instances. Prior art snapshot logs or archives utilize one or both of these indicators. For example, Altman et al. (US 6,349,361) provides a snapshot system using timestamps to name/identify snapshots (Column 10, lines 45-56).

14. **Claims 17 and 20** are rejected under 35 U.S.C. 103(a) as being unpatentable over Bridge (US 6,530,035) in view of Tam (US 6,411,969).

15. As per **claims 17 and 20** (New), Bridge discloses "A method as in claim 1" **[See rejection to claims 1 and 10 above]** "further comprising: performing a replication process between the primary replication volumes and secondary storage volumes," **["the invention relates to a method and system for managing storage systems containing multiple storage devices" (Column 1, lines 9-11) and also that "to protect against the loss of information, data on the system can be *mirrored* (i.e., duplicated and stored) on two or more separate storage locations" (Column 1, lines 50-52)]**.

Bridge does not disclose expressly "the replication process utilizing a daily or hybrid backup implementation."

It would have been obvious to one of ordinary skill in the art at the time the invention was made to perform daily or hybrid backups in the mirroring system as taught by Bridge since daily or hybrid backups are well known methods of backing up data **[As evidence, Tam discloses "It is often a standard practice to automatically back-up data on a daily or other periodic basis and store this data on tape or disk" (Column 1, lines 28-30)].**

III ACKNOWLEDGMENT OF ISSUES RAISED BY THE APPLICANT

Response to Amendment

16. Applicant's arguments filed on April 19, 2006 with respect to **claim 1** have been considered but are moot in view of the new ground(s) of rejection.

6. Applicant's arguments filed April 19, 2006 with respect to claim 10 have been fully considered and are not persuasive.

7. As required by **M.P.E.P. § 707.07(f)**, a response to these arguments appears below.

a. ARGUMENTS CONCERNING FORMAL MATTERS

8. The applicant's traversal of the formal requirements requested by the examiner are addressed in the following section as required by **M.P.E.P. § 707.07(f)**.

IV ARGUMENTS CONCERNING PRIOR ART REJECTIONS

1st POINT OF ARGUMENT:

9. Regarding the applicant's remarks with respect to claim 10 that Bridge (US 6,530,035) does not disclose failure groups being divided amongst logical volumes, it is the examiner's position that claim 10 does not contain this limitation. Claims must be given the broadest reasonable interpretation during examination and limitations appearing in the specification but not recited in the claim are not read into the claim (See M.P.E.P. 2111 [R-1]). Claim 10 does not recite anywhere that failure groups are divided amongst logical volumes; therefore, the examiner rejects claim 10 for the reasons explained above.

10. All arguments by the applicant are believed to be covered in the body of the office action or in the above remarks and thus, this action constitutes a complete response to the issues raised in the remarks dated April 19, 2006.

V. CLOSING COMMENTS

Conclusion

11. **THIS ACTION IS MADE FINAL**. Applicant is reminded of the extension of time policy as set forth in 37 C.F.R. 1.136(a).

A shortened statutory period for reply to this final action is set to expire three months from the mailing data of this action. In the event a first reply is filed within **two months** of the mailing date of this final action and the advisory action is not mailed until after the end of the **three-month** shortened statutory period, then the shortened statutory period will expire on the data the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing data of the advisory action. In no event, however, will the statutory period for reply expire later than **six months** from the mailing date of the final action.

VI. CITATION OF RELEVANT ART

12. The reference to Bridge (US 6,530,035) was not correctly cited in the last Office action. The correct citation is shown on the attached PTO-892.

13. The following reference teaches a disk array system and a method of preventing failure of a disk array system.

US PATENT

US 2005/0114728

VII. STATUS OF CLAIMS IN THE APPLICATION

14. The following is a summary of the treatment and status of all claims in the application as recommended by **M.P.E.P. § 707.07(i)**:

a(1) CLAIMS REJECTED IN THE APPLICATION

15. Per the instant office action, **claims 1-20** have received a second action on the merits and are subject of a final rejection.

16. For at least the above reasons it is the examiner's position that the applicant's claims are not in condition for allowance.

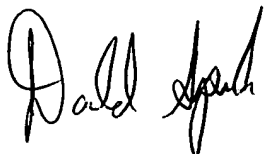
VIII. DIRECTION OF ALL FUTURE REMARKS

17. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Yaima Campos whose telephone number is (571) 272-1232. The examiner can normally be reached on Monday to Friday 8:30 AM to 5:00 PM.

IMPORTANT NOTE

18. If attempts to reach the above noted Examiner by telephone are unsuccessful, the Examiner's supervisor, Mr. Donald Sparks, can be reached at the following telephone number: Area Code (571) 272-4201.

19. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



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